

A Synopsis of the Odonat Genus LEUCORHINIA Britt

BY DR. H. A. HAGEN.*

[The genus *Leucorhinia* was first characterized by C. C. Brittinger in 1850, as follows :

The following species, which, by the metallic lustre of the upper surface of their body, by the form, dorsal flanks and appendages of the abdomen, by a triangular black spot on the base of the hind wings, and by their white frons and nasus, form a very natural group, I have already separated in 1845, as a distinct genus under this name. (Translated from Sitzungsber. Akad. Wissenschaft. Wien, 1850, Bd. iv, p. 333.)

The "following species" are: 1. *rubicunda* Linn.; 2. *pectoralis* Charp.; 3. *dubia* Vander Lind.; 4. *albifrons* Burm.; 5. *caudalis* Charp.; 6. *ornata* Britt. (= *caudalis* Charp.)

Dr. Brauer in his *Verzeichniss der bis jetzt bekannten Neuropteren im Sinne Linne's*, Zweiter Abschnitt (Verhdl. k. k. zool.-bot. Gesell. Wien, xviii, pp. 711-742, 1868) places the genus *Leucorhinia* in the "Fourth Group" of the "Tribus Libellulina." This fourth Group is characterized by having

The costal margin on the basal side of the nodus entire, suture between the eyes short, triangles equally placed, *i. e.* those of the hind wings reaching as far outwards as the middle cell† of the forewings.

The genus *Leucorhinia* belongs to the second section of the fourth group, which section includes those

Species with heart-shaped, almost entirely four-sided hind margin of the prothorax, notched or broadly bilobed on the free margin; only one, or at the most two (then mostly unsymmetrical) cross veins in the middle cell. The triangle of the hindwings reaches as far outwards as the end of the middle cell in the forewings. Both triangles normal (*i. e.* the anterior side not broken). Vulva mostly covered, when open the last segments are very short; hamules always bifid. Eyes always united for a short distance. Claws with a tooth.

Lastly the genus *Leucorhinia* is itself characterized as follows :

Sectors of the arculus arising separated from a point. Hindwings broader at the base. Membranule distinct. Triangle moderately wide. Reticulation otherwise as in *Diplax*. Less than ten antecubitals; 2-3 discoidal rows. Lobe of prothorax large, broad, bilobed. Abdomen slender, somewhat shorter than the wings, more or less widened in the male, somewhat thicker at the base. Genitalia little prominent, vulva covered, the valve often shrunken. Sides of the eighth segment not widened.

Dr. Brauer included in *Leucorhinia* the following species: *pectoralis*, *dubia*, *rubicunda*, *albifrons*, *caudalis*, *intacta*, *hudsonica*, *elisa* Hag., *amanda* Hag., *ornata* Ramb. and 2 sp. Ind. Orient.

* In February, 1890, Dr. Hagen sent me the MS. of this paper and the accompanying figures (see Pl. x) with permission to publish the same. With his consent, I have made some additions to his paper. These are enclosed in brackets [], and for them I alone am responsible.—Philip P. Calvert.

† Median space, espace médian, lower basal cell, of other authors.

Dr. Hagen, in the "Synopsis of the Odonata of America" (Proc. Bost. Soc. Nat. Hist. xviii, pp. 20-96, 1875) referred *elisa* to *Celithemis* (as previously indicated by Walsh), and *amanda* and *ornata* to *Diplax*.

Mr. W. F. Kirby, in his "Revision of the Subfamily Libellulina" (Trans. Zoöl. Soc. London, xii, part 9, pp. 249-348, pls. li-lvii, 1889), places *elisa*, *amanda* and *ornata* in *Celithemis*; *albifrons*, *pectoralis*, *dubia*, *rubicunda*, *hudsonica* and *intacta* in *Leucorhinia*, and *caudalis* in *Cenotiata* (Buch.)

The genus *Leucorhinia* as here understood, is equivalent to the combined genera *Leucorhinia* and *Cenotiata* of Kirby, or to the *Leucorhinia* of Brauer with the omission of the species *elisa* et seq.]

Pl. x, fig. 8, shows the right hamulus of *intacta* drawn from below, the insect turned over. The whole part in the middle, *m*, is pale membranaceous, and in *rubicunda* is often inflated. The branch *a* is movable, and is always entirely shut down when the penis is visible between the two hamuli of the right and left sides. This arrangement of the hamulus, which is indeed rather peculiar, is a character of the genus *Leucorhinia*, and excludes the species put in by Dr. Brauer (*elisa* et seq.). The anterior branch of the hamules, *a*, is represented in *á*, as seen from the side, and is apparently very different.

[*Elisa*, *amanda* and *ornata* differ from the other species also by having the pterostigma proportionately longer and narrower; in *elisa* and *amanda* the last antecubital (antenodal) of the forewings is not continuous.

The genus *Leucorhinia* thus defined comprises eleven known species, viz.: 1. *triedra* Müll. (*caudalis* Charp.) 2. *albifrons* Burm.; 3. *frigida* Hag.; 4. *pectoralis* Charp.; 5. *borealis* Hag.; 6. *rubicunda* Linn.; 7. *proxima* (Hag. MS.) Calvert; 8. *hudsonica* Selys; 9. *dubia* Vander Linden; 10. *glucialis* Hag.; 11. *intacta* Hag.]

1. *Leucorhinia triedra* Müller.

[Northern, Eastern and Central Europe.—Selys.*]

I am convinced that for *caudalis* Charp. the name *triedra* Müller should be accepted. In 1850, neither Baron de Selys nor I had studied Müller's work thoroughly, and I at least did not know the varieties of *caudalis* as well as in later times. Müller's description (Nova Acta Nat. Curios., iii, p. 129) agrees entirely with all the varieties and cannot be applied to any other species. The only ob-

* The geographical distribution of the European species is, according to Baron de Selys-Longchamps' *Odonates de l'Asie Mineure et Revision de ceux des autres parties de la Faune dite Européenne* (Ann. Soc. Ent. Belg., xxxi, pp. 1-85, 1887), p. 75.—P. P. C.

jection we can make against the name *triedra* is that we have been accustomed for fifty years to *caudalis*—from not having studied Müller's work.

2. ***Leucorhinia albifrons*** Burmeister.

[Northern and Eastern Europe; Switzerland; Vosges Mountains.—Selys.]

3. ***Leucorhinia frigida*** n. sp.

Hagen, Proc. Bost. Soc. Nat. Hist. xviii, p. 79, 1875 (no description).

♂ ♀ Massachusetts; ♂ N. Red River, British America; Ontario; Dakota. This is the smallest species except *hudsonica*, and seems to be rare.

Length 30 mm. Alar expanse 45 mm. Pterostigma 1.5 mm. Abdomen 19 mm. Inferior wing 22 mm.

♂.—Front white, labrum yellowish white, labium black, vertex and occiput black; head behind and thorax with whitish hairs; thorax pale olive-brown, with two black spots near the legs, but much darker in the adult male. Abdomen of the form of *albifrons*, black; segments 1-3 pale olive-brown, except the extreme apex of 3; the basal half of dorsal suture of 6 and 7 with a narrow yellow stripe; adult male with segments 1-4 entirely covered by bluish white powder. Legs black.

Superior appendages black, pointed, with about five tubercles below (Pl. x, fig. 7). Inferior appendage black, elongated, narrowed to tip, a little emarginate (Pl. x, fig. 2). Hamulus wide open, basal branch thin, directed backwards.

Wings hyaline, venation black, costa and some parts after pterostigma yellowish. Anterior wings with a very small black basal spot in subcostal and median spaces; posterior wings with similar spots, but larger, the one in the median space sending a branch along the border of the wing to form a triangular spot, which is emarginate (Pl. x, fig. 17). One male has the wings a little yellowish at base. Pterostigma oblong, brown, a little paler on both sides; 7 antecubitals, 7 post-cubitals.

♀.—Similar; labium white on both sides; abdomen broader, segment 2 above with a large, round, yellow spot, 4-8 with dorsal spots narrowing behind, the last three only short, narrow bands. Appendages black. Vulvar lamina half as long as the 9th segment, bifid to base, valves sharply pointed (Pl. x, fig. 20).

This species differs from the others by: first, its small size; second, the more elongated pterostigma; third, the inferior appendage of the ♂ and the vulva of the ♀. I think I have seen more specimens, and from other States, but the numerous faunal lists are not yet tabulated.

4. ***Leucorhinia pectoralis*** Charpentier.

[Northern and Central Europe.—Selys.]

5. ***Leucorhinia borealis*** n. sp.

Hagen, Proc. Bost. Soc. Nat. Hist., xviii, p. 78, 1875 (no description).

Six males and four females from Saskatchewan River and Fort Resolution, Hudson's Bay Territory by Kennicott. Abdomen 27 mm. Hindwing 30 mm.

This species is intermediate between *pectoralis* and *rubicunda*. Of *pectoralis* it has the stature, the somewhat brighter colors, and the vulva of the female. Otherwise it is decidedly very near to *rubicunda* by the wings and the thinner abdomen. Pl. x, fig. 10, shows the hamulus, viewed from the side. In *rubicunda* the membrane *m* is inflated in lifetime, and in some specimens after death. This shape is figured by me in the "Revue des Odonates" Pl. I. I have not seen such inflation in the other four European species even when alive. All my figures represent the hamulus opened, as it is when no copulation is in progress,—the regular position. But as I stated before, the basal branch (I have marked the articulation) can be shut in just as the blade of a pocket-knife. I have, for comparison, given the figure (Pl. x, fig. 11) of the hamulus of *rubicunda* when the membrane is *not* inflated.

The "pièce antérieure" of *borealis* is similar to that of *rubicunda*; the long pointed brush of hairs, always present in *pectoralis*, is wanting in *borealis*. The vulva of the female (Pl. x, fig. 21) decides the difference between *borealis* and *rubicunda*. But there is another difference: *borealis*, both male and female, has always a large red spot on the dorsum of the eighth abdominal segment, just as on the seventh and preceding segments. *Rubicunda* and *pectoralis* never have this spot.

6. *Leucorhinia rubicunda* Linné.

[Northern and Central Europe; Northern Asia.—Selys.]

I have again compared the male *rubicunda* from Wilni, Siberia. As I have stated long ago, I find no difference, except the shape of the inferior appendage (Pl. x, fig. 5), which may be after all a different variety.

7. *Leucorhinia proxima* (Hagen MS.) Calvert.

[Hagen, Proc. Bost. Soc. Nat. Hist. xviii, p. 79, 1875 (no description). Calvert, Trans. Amer. Ent. Soc. xvii, p. 38, pl. v, figs. 5, 6, 1890. *Leucorhinia perversa* Hagen, MS.]

I have described only the male, my types being from Manchester, Kennebec County, Me., and Pictou, Nova Scotia. Dr. Hagen's types of *perversa*, at one time supposed by him to be a distinct species, were three males from Cape Breton, Nova Scotia, and one male from Massachusetts. In 1875, Dr. Hagen also indicated *proxima* from the White Mountains of New Hampshire.]

Three males, one from British America, high up, the others from Victoria, Vancouver's Island. Abdomen 21-62 mm., hindwing 25-27 mm.

This species is near to *rubicunda*.

All three males with labium entirely black. Abdomen a little covered with whitish blue powder, on the under side only; segment 2 with a large rounded yellowish dorsal spot; 3 yellow to the suture, and a narrower yellowish spot beneath the suture; dorsal crest of 4 and 7 with a faint yellowish line (Pl. x, fig. 1).

I have looked through my whole collection for the female, and I believe that three females from Loon Lake, Colvillo Valley, State of Washington, collected by myself July 23, 1882, belong to this species. This locality is just as far off from Vancouver Island and from the border of British America. I caught together with them one ♀ of *intacta*, very easily to be recognized by the vulva.

♀.—Abdomen 22 mm., hindwing 24 mm., pterostigma 2 mm. (a little longer than in the ♂).

Labium, its lobes and labrum, black. Abdomen having segment 2 with a large, round, yellow spot, sides below yellow; segment 3 yellow to suture, and a smaller spot after suture; 4-7 with a narrow yellow dorsal band on the basal half of crest. Appendages black. Vulva with two short approximated tubercles (Pl. x, fig. 22) (similar to *L. rubicunda*). Wings as in the male.

8. ***Leucorhinia hudsonica*** Selys.

[*Libellula hudsonica* Selys, Revue des Odonates, p. 53, 1850.]

Diplax hudsonica Hagen, Syn. Neur. N. Am., p. 180, 1861.

Leucorhinia hudsonica Hagen, Proc. Bost. Soc. Nat. Hist., xviii, p. 78, 1875.

Leucorhinia Hogeni Calvert, Trans. Amer. Ent. Soc. xvii, p. 36, pl. v, figs. 2, 3, 4, 10, 1890. Ent. News, I, p. 73, 1890.]

Lake Winnipeg; Saskatchewan River and Ft. Resolution, Hudson Bay Territory; Massachusetts; [Pictou, Nova Scotia.]

I have tried to make a thorough study of *hudsonica* and *dubia*. Of the first, I have before me fourteen specimens, of the latter thirty-seven. The size of both species varies.

The specimens of *dubia* are usually larger, except one female from Braunsberg, East Prussia, whose hindwing is 22 mm. long. *Hudsonica* has the hindwing 20-24 mm., abdomen 20 mm.

At first I thought that the form of the valves of the female, "presque quadrangulaires, rapprochés," in *dubia* was deciding; but a careful study of the seventeen females shows a remarkable difference in dead, *dry* specimens. I have never had more than one live specimen in my hands and it was somewhat young. It is the same which I have figured and described, and it is still before me. It is from Gilgenau, East Prussia (Pl. x, fig. 19A), and it *agrees with my*

figure and description; one specimen from Umea (fig. 19D) is similar. The next to it is the specimen from Luneburg (fig. 19C). All the others show the valves to be more or less shrunk, or bent, or separated, especially in the Kiel specimen (fig. 19B). Now, there can be no doubt that all these different forms (see Pl. x, fig. 19) are the consequence of the shrinking after death; and they may also result even when the females have copulated and *deposited the eggs*, as I have ascertained in several specimens.

My first figure of the valvules of *hudsonica* (fig. 18A) is to be compared with the first of *dubia* "lobes rapprochés, oblonges, tronques au bout obliquement (fig. 19A)," the second (fig. 18B) to the last ones of *dubia*.

The hamules of both species are similar, but to be separated by the black, polished, triangular projection, *x*, triangular in *dubia* (fig. 12), narrower at base and larger on tip in *hudsonica* (fig. 13).

The appendages of the males of the two species differ. *Dubia* has the inferior appendage only half as long as the superiors, the tip of which is crenated. *Hudsonica* has the inferior appendage proportionately longer, reaching the obliquely truncated inferior tip of the superiors.

The pattern and coloring of the two species vary much, but *hudsonica* has in some specimens of both sexes a spot on the 8th abdominal segment, which I never saw in *dubia*. The color of the labium varies much in *hudsonica*, in so far as the external margin, in the female, is pale and sometimes connected with a large white spot, as in the male.

I think *hudsonica* can be retained as a different species.

9. **Leucorhinia dubia** Vander Linden.

[Northern and Central Europe.—Selys.]

10. **Leucorhinia glacialis** n. sp.

[Hagen, Proc. Bost. Soc. Nat. Hist., xviii, p. 79, 1875. No description.]

This species is related to *intacta*. I have sixteen males before me from Massachusetts; Cape Breton, Nova Scotia; London, Ontario; Michipicoten on Lake Superior; and Reno, Nevada (Mr. Morrison, 1878). [Elsewhere in his MS. Dr. Hagen refers to a male *glacialis* from the White Mts. of New Hampshire, collected by Morrison.]

♂.—Abdomen 23–25 mm. Hindwing 24–27 mm.

Labrum milk-white; labium and lobes black; thorax with a large yellow band, sometimes contracted after base. Wings as in *intacta*. Abdomen black, segment 2, and 3 to suture and a triangular spot after suture, yellowish brown; no spots or lines on 7 or 8; one specimen just out of the nymph, its colors not yet finished.

has on the dorsal crest at the base of 7 and 8, a small yellowish streak. Appendages similar, inferior (Pl. x, fig. 3) as in *proxima*. Pl. x, fig. 14, shows side view of hamulus; the end *b* with strong bristles. The "pièce antérieure" is without any tubercles.

I do not know the female. The only female from Reno belongs to *intacta*?

11. ***Leucorhinia intacta*** Hagen.

[*Diplax intacta* Hagen, Syn. Neur. N. Am. p. 179, 1861.

Walsh, Proc. Acad. Phila., 1862, p. 400.

Leucorhinia intacta Hagen, Proc. Bost. Soc. Nat. Hist., xviii, p. 78, 1875.

Calvert, Trans. Amer. Ent. Soc. xvii, p. 39, pl. v, figs. 1, 7, 8, 9, 1890.]

Canada; Maine; Massachusetts; [Pennsylvania]; Ohio; Illinois; Michigan; Wisconsin; [South Dakota]; Nevada; Washington (State).

This species varies much in size and color.

Among the forty-seven males just carefully examined, the labium is entirely black *only in five specimens*. It is more or less white in the other forty-two specimens. In one-third of these forty-two the labium is black with the external half of the lobes white (Pl. x, fig. 15A) in another third, only the apical half of the external half of the lobes is white (fig. 15B); in the remaining third the white spot is smaller, usually not reaching the tip of the lobe (fig. 15C), and less well defined, sometimes even to be recognized with difficulty. The five males with black labia are all from different localities, East or West, or Middle States, and from the same localities with the white-marked ones. I collected in Massachusetts, on the same day and at the same place, males with entirely dark labia and also those with the outer half of the lobe white. Further, the black ones do *not* belong to *older* specimens. Indeed, the half white ones are as old as the others. But the young males with colors not yet complete, have labium and lobes pale throughout.

The labrum is white, but sometimes more or less blackish in the middle.

On the abdomen, even of very dark males, a twin yellow spot is usually visible on segment 7.

Inferior appendage of the male widely emarginate, bifid (fig. 6); it varies much, as it is more or less emarginate, its branches more or less diverging and more or less pointed (I had formerly called such an exaggerated form *L. pilosa*).

The male has on each side of the "pièce antérieure" of the second segment [anterior lamina], an oval, elevated, black tubercle, flat, en-

tirely covered with black spines, which character separates this species from all others (fig. 16).

Length of abdomen of the male 20–24 mm., hindwing 21–29 mm. The average dimensions of Massachusetts specimens are *mostly* near the smaller numbers, of the Western specimens near the larger.

Vulva with two distant lobes, and behind them two accessory palps in the middle of the segment (fig. 23).

The basal spot on hind wing is small and emarginate below; all the others are only beginning (seen with strong lens). The wings of the female vary much more, the triangular spot on hindwings is sometimes larger, also in subcostal space, and in the forewings more or less long, sometimes divided into two transversal spots, the wings sometimes yellow to triangle or farther, and sometimes smoky.

This species is the most common of its genus in the Northern parts of the United States. I have not seen it, however, from the Colorado Mountains where *Diplax scotica* flies.

I possess the nymphæ of *pectoralis* and *triedra* raised by myself, and of *dubia* raised by Heyer. The nymphæ of *triedra* differs from the others and is nearer to *Cordulia*. The descriptions are not yet published. I think that I have also the nymphæ of *intacta*.

EXPLANATION OF PLATE X.

- Fig. 1.—Pattern of coloring of abdomen of *Leucorhinia proxima*.
 “ 2.—Inferior appendage of *L. frigida* ♂; 2A, its tip.
 “ 3.— “ of *L. glacialis* ♂.
 “ 4.— “ of *L. proxima* ♂.
 “ 5.— “ of *L. rubicunda* ♂ from Wilni, Siberia.
 “ 6.— “ of *L. intacta* ♂.
 “ 7.—Appendages of *L. frigida* ♂, viewed from the side.
 “ 8.—Hamule of *L. intacta* ♂, viewed from below.
 “ 9.— “ of *L. proxima* ♂ (form *perversa*), viewed from below.
 “ 10.— “ of *L. borealis* ♂, viewed from the side.
 “ 11.— “ of *L. rubicunda* ♂, viewed from the side.
 “ 12.— “ of *L. dubia* ♂, viewed from the side.
 “ 13.— “ of *L. hudsonica* ♂, viewed from the side.
 “ 14.— “ of *L. glacialis* ♂, viewed from the side.
 “ 15.—A, B, C. Three patterns of coloring of labium of *L. intacta* ♂.
 “ 16.—Tubercles on the “pièce antérieure” of *L. intacta* ♂.
 “ 17.—Base of hindwing of *L. frigida*.
 “ 18.—A, B. Valves of *L. hudsonica* ♀.
 “ 19.—A–F. “ of *L. dubia* ♀.
 “ 20.— “ of *L. frigida* ♀.
 “ 21.— “ of *L. borealis* ♀.
 “ 22.— “ of *L. proxima* ♀.
 “ 23.— “ of *L. intacta* ♀.

a, basal branch of hamule.

b, apical branch of hamule.

art, articulation of basal branch.

m, membrane lining the hamule.

x, triangular polished projection.

á, (figs. 8, 9) basal branch of hamule, separated and viewed from side